

RECORDS OF REVISION

MODEL No. : LK520D3LB2S

SPEC No. : LD-K21Y20

[illegible]



1. Application

This specification applies to the color 52.0" TFT-LCD module LK520D3LB2S

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2. Overview

This module is a color active matrix LCD module incorporating amorphous silicon TFT (Thin Film Transistor). It is composed of a color TFT-LCD panel, driver ICs, control circuit, power supply circuit, LED drive circuit and back light system etc. Graphics and texts can be displayed on a $1920 \times \text{RGB} \times 1080$ dots panel with one billion colors by using 10bit LVDS (Low Voltage Differential Signaling) to interface, +12V of DC supply voltages.

This module also includes the LED-PWB module to drive the LED. ($\pm 120\text{mA}$ of DC supply current)

And in order to improve the response time of LCD, this module applies the Over Shoot driving (O/S driving) technology for the control circuit. In the O/S driving technology, signals are being applied to the Liquid Crystal according to a pre-fixed process as an image signal of the present frame when a difference is found between image signal of the previous frame and that of the current frame after comparing them.

With this technology, image signals can be set so that liquid crystal response completes within one frame. As a result, motion blur reduces and clearer display performance can be realized.

This LCD module also adopts Quadruple-Frame Rate driving method including FRC (Frame Rate Control) function on the control circuit. Therefore the input signal to this LCD module is Single Frame Rate, but the output is Quadruple-Frame Rate picture (inserting the intermediate image which is generated by the FRC).

With combination of these technologies, motion blur can be reduced and clearer display performance can be realized.

3. Mechanical Specifications

| Parameter | Specifications | Unit |
|--------------------------------|--|-------|
| Display size | 132.174 (Diagonal) | cm |
| | 52.0 (Diagonal) | inch |
| Active area | 1152.0(H) \times 648.0 (V) | mm |
| Pixel Format | 1920(H) \times 1080(V) (1pixel = R + G + B dot) | pixel |
| Pixel pitch | 0.600 (H) \times 0.600 (V) | mm |
| Pixel configuration | R, G, B vertical stripe | |
| Display mode | Normally black | |
| Unit Outline Dimensions [Note] | 1227 (W) \times 741 (H) \times 27.6 (D) | mm |
| Mass | 14.7 | kg |
| Surface treatment | Clear LR(Low Reflection coating) Hard coating: 3H | |

[Note] Outline dimensions are shown in Fig.17 (excluding protruding portion)



4. Input Terminals

4.1. TFT panel driving

CN1 (Interface signals and +12V DC power supply) (Shown in Fig.1)

Using connector : FI-RNE51SZ-HF (Japan Aviation Electronics Ind., Ltd.)

Mating connector : FI-RE51HL, FI-RE51CL (Japan Aviation Electronics Ind., Ltd.)

Mating LVDS transmitter : THC63LVD1023 or equivalent device

| Pin No. | Symbol | Function | Remark |
|---------|--------------|--|-------------------|
| 1 | VCC | +12V Power Supply | |
| 2 | VCC | +12V Power Supply | |
| 3 | VCC | +12V Power Supply | |
| 4 | VCC | +12V Power Supply | |
| 5 | VCC | +12V Power Supply | |
| 6 | Open | | Open |
| 7 | GND | | |
| 8 | GND | | |
| 9 | GND | | |
| 10 | AIN0- | Aport (-)LVDS CH0 differential data input | |
| 11 | AIN0+ | Aport (+)LVDS CH0 differential data input | |
| 12 | AIN1- | Aport (-)LVDS CH1 differential data input | |
| 13 | AIN1+ | Aport (+)LVDS CH1 differential data input | |
| 14 | AIN2- | Aport (-)LVDS CH2 differential data input | |
| 15 | AIN2+ | Aport (+)LVDS CH2 differential data input | |
| 16 | GND | | |
| 17 | ACK- | Aport LVDS Clock signal(-) | |
| 18 | ACK+ | Aport LVDS Clock signal(+) | |
| 19 | GND | | |
| 20 | AIN3- | Aport (-)LVDS CH3 differential data input | |
| 21 | AIN3+ | Aport (+)LVDS CH3 differential data input | |
| 22 | AIN4- | Aport (-)LVDS CH4 differential data input | |
| 23 | AIN4+ | Aport (+)LVDS CH4 differential data input | |
| 24 | GND | | |
| 25 | BIN0- | Bport (-)LVDS CH0 differential data input | |
| 26 | BIN0+ | Bport (+)LVDS CH0 differential data input | |
| 27 | BIN1- | Bport (-)LVDS CH1 differential data input | |
| 28 | BIN1+ | Bport (+)LVDS CH1 differential data input | |
| 29 | BIN2- | Bport (-)LVDS CH2 differential data input | |
| 30 | BIN2+ | Bport (+)LVDS CH2 differential data input | |
| 31 | GND | | |
| 32 | BCK- | Bport LVDS Clock signal(-) | |
| 33 | BCK+ | Bport LVDS Clock signal(+) | |
| 34 | GND | | |
| 35 | BIN3- | Bport (-)LVDS CH3 differential data input | |
| 36 | BIN3+ | Bport (+)LVDS CH3 differential data input | |
| 37 | BIN4- | Bport (-)LVDS CH4 differential data input | |
| 38 | BIN4+ | Bport (+)LVDS CH4 differential data input | |
| 39 | GND | | |
| 40 | I2C_SCL | I2C CLK | |
| 41 | I2C_SDA | I2C Data | |
| 42 | Open | | Open |
| 43 | B-INT | I2C bus enable(H:enable, L:disable) [Note 1] | Pull down : (GND) |
| 44 | PANEL_SEL | (PANEL Sel Signal) [Note 2] | |
| 45 | FRC_PWR_CTRL | Power on sequence(DC/DC On Signal) | Pull down : (GND) |

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| | | | |
|----|----------|--|-------------------|
| 46 | SA_MODE | SA Mode Sel Signal (L:Set mode, H:Stand alone(SA) mode) | Pull up +3.3V |
| 47 | PANEL_ON | Power on sequence | Pull down : (GND) |
| 48 | FRC_RST | FRC IC RESET | Pull down : (GND) |
| 49 | Open | | Open |
| 50 | TCON_RDY | TCON ready signal (H:OK, L:NG) | |
| 51 | Open | | Open |

[Note] GND of a liquid crystal panel drive part has connected with a module chassis.

CN2 (+12V DC power supply)

Using connector : BM04B-PASS (J.S.T.Mfg Co., Ltd.)

Mating connector : (PAP-04V-S) (J.S.T.Mfg Co., Ltd.)

| Pin No. | Symbol | Function | Remark |
|---------|--------|-------------------|--------|
| 1 | VCC | +12V Power Supply | |
| 2 | VCC | +12V Power Supply | |
| 3 | GND | | |
| 4 | GND | | |

[Note 1] B_INT

| Pin No. | Symbol | Function |
|---------|--------|--|
| 43 | B_INT | Select I2C Bus 0: FRC is I2C master. (EEPROM access mode) 1: FRC is I2C slave. (μ com mode(SA_MODE = '1')) |

[Note 2] PANEL_SEL

| R1 | Panel type | Address |
|------|------------|--|
| Open | Standard | Slave address and Power sequence are standard. |

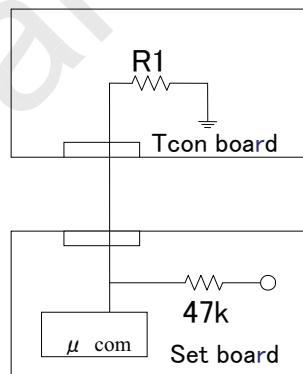


Fig.1 Block diagram of PANEL_SEL



4.2. LVDS Data order

| LVDS Mapping | |
|--------------|---------|
| Data | [JEIDA] |
| TA0 | R4 |
| TA1 | R5 |
| TA2 | R6 |
| TA3 | R7 |
| TA4 | R8 |
| TA5 | R9 |
| TA6 | G4 |
| TB0 | G5 |
| TB1 | G6 |
| TB2 | G7 |
| TB3 | G8 |
| TB4 | G9 |
| TB5 | B4 |
| TB6 | B5 |
| TC0 | B6 |
| TC1 | B7 |
| TC2 | B8 |
| TC3 | B9 |
| TC4 | HSYNC |
| TC5 | VSYNC |
| TC6 | DE (*) |
| TD0 | R2 |
| TD1 | R3 |
| TD2 | G2 |
| TD3 | G3 |
| TD4 | B2 |
| TD5 | B3 |
| TD6 | N/A |
| TE0 | R0 |
| TE1 | R1 |
| TE2 | G0 |
| TE3 | G1 |
| TE4 | B0 |
| TE5 | B1 |
| TE6 | N/A |

NA:Not Available

(*)Since the display position is prescribed by the rise of DE(Display Enable) signal, please do not fix DE signal during operation at "High".

4.3. LVDS Mapping

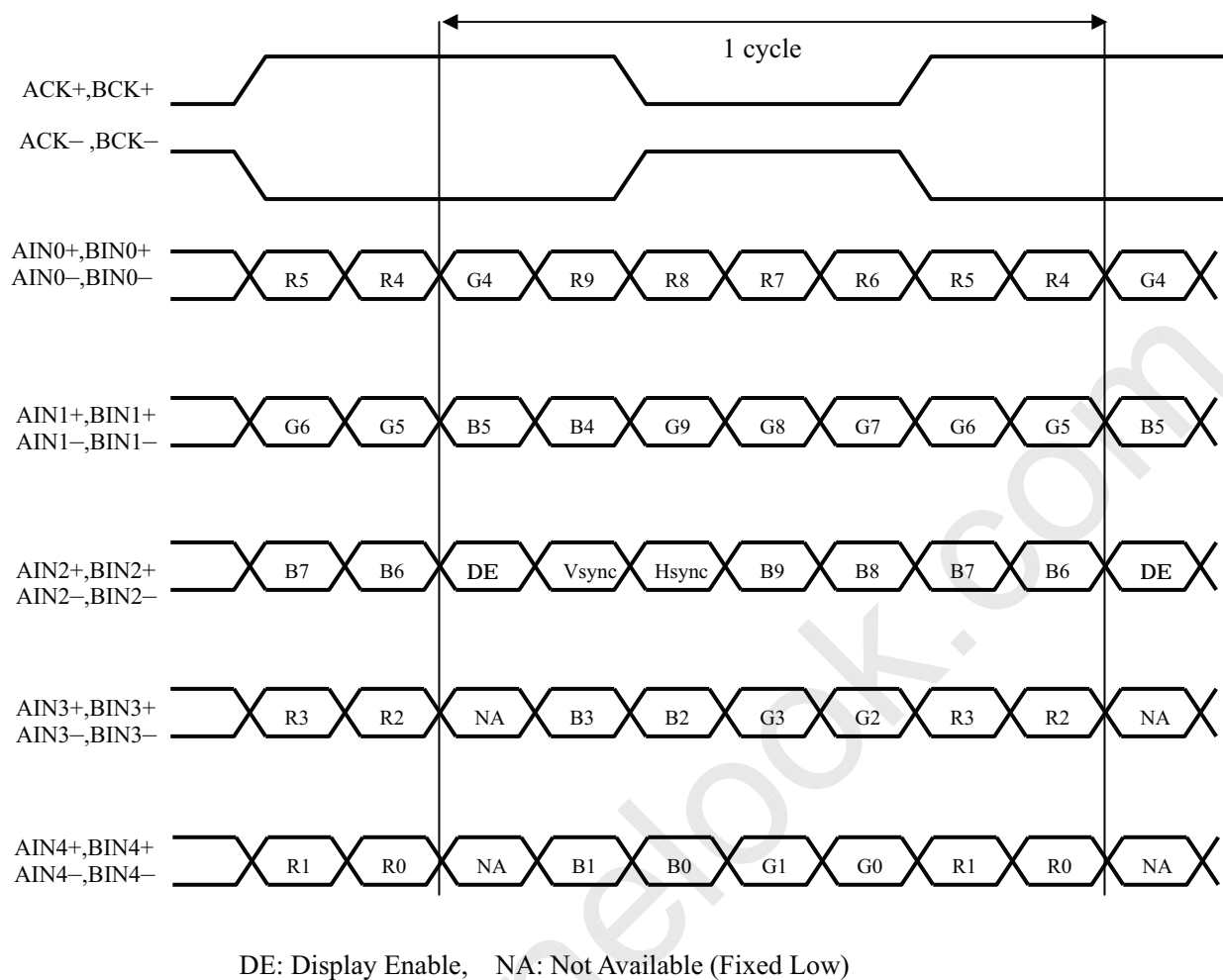


Fig.2 LVDS Mapping



4.4. Panel ID data map

The slave address of EEPROM(24C02) is AA.

| No. | Item | Spec(Ex.) | Address | Data | Remark |
|-----|---------------|-------------|---------|---|--------------------------|
| 1 | Vender code | SHARP | 00 | 03 | Select Note1) *Sony use. |
| 2 | Screen size | 52" | 01 | 34 | HEX data |
| 3 | H-Resolution | 1920 | 02,03 | 07,80 | HEX data |
| 4 | V-Resolution | 1080 | 04,05 | 04,38 | HEX data |
| 5 | V-Frequency | 200/240Hz | 06 | 02 | Select Note2) |
| 6 | Data format | 10bit | 07 | 02 | Select Note3) |
| 7 | Revision code | 001 | FA~FF | 30,30,31,00,00,00 | ASCII Note4) *Sony use. |
| 8 | Part Number | LK520D3LB2S | E0~EF | 4C,4B,35,32,30,44, 33,4C,42,32,53,00, 00,00,00,00 | ASCII Note4) *Sony use. |

[Note 1] Vender code

| Vender code | Data |
|-------------|------|
| - | 00 |
| - | 01 |
| - | 02 |
| SHARP | 03 |
| - | 04 |
| - | 05 |
| - | 06 |

[Note 2] V-Frequency

| V-Frequency | Data |
|-------------|------|
| 50/60Hz | 00 |
| 100/120Hz | 01 |
| 200/240Hz | 02 |

[Note 3] Data format

| Data format | Data |
|-------------|------|
| 6bit | 00 |
| 8bit | 01 |
| 10bit | 02 |

[Note 4] An empty address inputs "00".

4.5. Interface block diagram

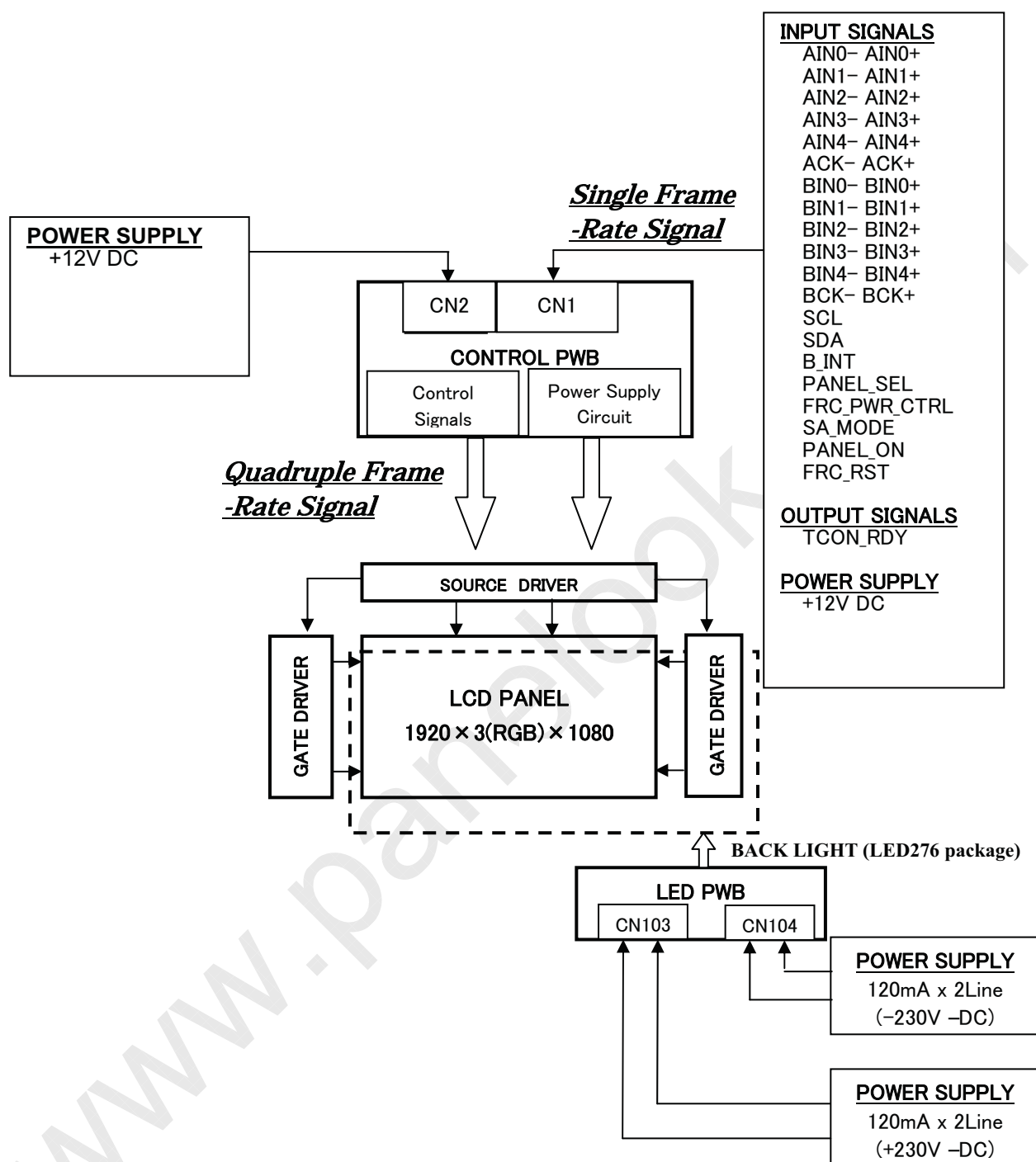


Fig.3 Interface block diagram



4.6. Backlight driving

CN103 (+120mA DC power supply)

Using connector: 51103-0400 (Molex)

Mating connector: XAP-04V-1 (JST)

| Pin No. | Symbol | Function | Remark |
|---------|--------------------|----------|--------|
| 1 | I _{+LED1} | +120mA | +230V |
| 2 | I _{+LED2} | | |
| 3 | Reserved | - | |
| 4 | Reserved | | |

CN104 (-120mA DC power supply)

Using connector: 51103-0500 (Molex)

Mating connector: XAP-05V-1 (JST)

| Pin No. | Symbol | Function | Remark |
|---------|--------------------|----------|--------|
| 1 | I _{-LED1} | -120mA | -230V |
| 2 | I _{-LED2} | | |
| 3 | Reserved | - | |
| 4 | Reserved | - | |
| 5 | Reserved | - | |

4.7. The back light system characteristics

The back light system is edge light type with 276 segment. (LS:4, LS:69packages)

The characteristics of the LED are shown in the following table. The value mentioned below is at the case of one LED.

| Item | Symbol | Min. | Typ. | Max. | Unit | Remarks |
|-----------|------------------|------|-------|------|------|---------|
| Life time | T _{LED} | - | 50000 | - | Hour | [Note] |

[Note] LED life time is defined as the time when brightness becomes 50% of the original value in the continuous operation under the T_a = 25°C

5. Absolute Maximum Ratings

| Parameter | Symbol | Condition | Ratings | Unit | Remark |
|--|------------------|------------------------|-------------|------|----------|
| Input voltage (for Control and FRC) | V _I | T _a = 25 °C | -0.3 ~ 3.6 | V | [Note 1] |
| 12V supply voltage (for Control) | V _{CC} | T _a = 25 °C | 0 ~ + 14 | V | |
| supply current (for LED driver) | I _{LED} | T _j = 25 °C | 150 | mA | |
| supply voltage (for LED driver) | V _{LED} | T _j = 25 °C | -242 ~ +242 | V | |
| Storage temperature | T _{stg} | - | -25 ~ +60 | °C | |
| Operation temperature (Ambient) | T _{opa} | - | -0 ~ +50 | °C | |

[Note 1] SCL, SDA, B_INT, PANEL_SEL, FRC_PWR_CTRL, SA_MODE, PANEL_ON, FRC_RST

6. Electrical Characteristics

6.1. Control circuit driving

Ta=25 °C

| Parameter | | Symbol | Min. | Typ. | Max. | Unit | Remark |
|--|---------------------|--------------------|---------------------|------|------------------------------|-------------------|-------------------------------------|
| +12V supply voltage | Supply voltage | V _{CC} | 11 | 12 | 13 | V | [Note 1] |
| | Current dissipation | I _{CC} | - | 2.1 | 4.0 | A | [Note 2] |
| | Inrush current | I _{RUSH1} | - | 9.4 | - | A | t ₁ =500μs [Note 4] |
| | | I _{RUSH2} | - | 3.2 | - | A | t ₁ >5ms |
| Permissible input ripple voltage | | V _{RP} | - | - | 100 | mV _{P-P} | V _{CC} = +12.0V |
| Differential input threshold voltage | High | V _{TH} | - | - | 100 | mV | V _{CM} = +1.2V [Note 6] |
| | Low | V _{TL} | -100 | - | - | mV | |
| Input Low voltage | | V _{IL} | 0 | - | 1.0 | V | [Note 5] |
| Input High voltage | | V _{IH} | 2.3 | - | 3.6 | V | |
| Input leak current(Low) | | I _{IL} | | | 400 | μA | V _I =0V |
| Input leak current(High) | | I _{IH} | | | 100 | μA | V _I =3.3V |
| Terminal resistor | | R _T | - | 100 | - | Ω | Differential input |
| Input Differential voltage | | V _{ID} | 100 | - | - | mV | [Note 3] |
| Differential input common mode voltage | | V _{CM} | V _{ID} /2 | 1.2 | 2.4- V _{ID} /2 | V | |

[Note]V_{CM}: Common mode voltage of LVDS driver.

[Note 1]

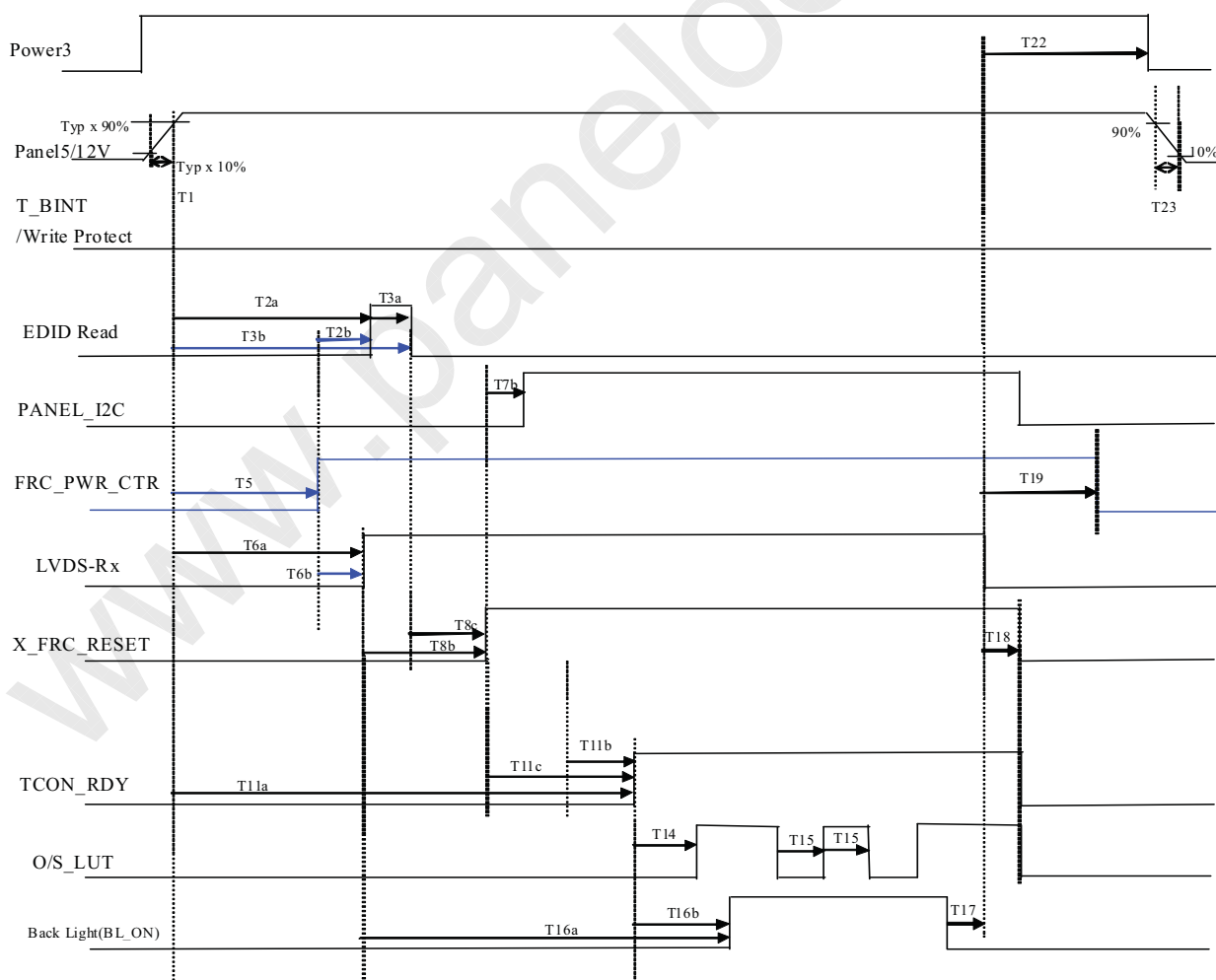


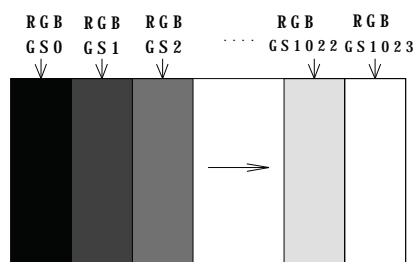
Fig.4 Timing chart of sequence

| | Min | Max | | Min | Max | | Min | Max | | Min | Max | Unit |
|-----|------|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|------|
| T1 | 0.47 | 10 | T7b | 60 | | T16b | 500 | | T23 | 0 | | msec |
| T2b | 60 | | T8b | 10 | | T17 | 100 | | | | | |
| T3b | 0 | 200 | T8c | 10 | | T18 | 0 | 10 | | | | |
| T5 | 10 | | T14 | 0 | | T19 | 0 | 45 | | | | |
| T6b | 50 | | T15 | 0.1 | | T22 | 0 | T22 | | | | |

[Note]About the relation between data input and back light lighting, please base on the above-mentioned input sequence. When back light is switched on before panel operation or after a panel operation stop, it may not display normally. But this phenomenon is not based on change of an incoming signal, and does not give damage to a liquid crystal display.

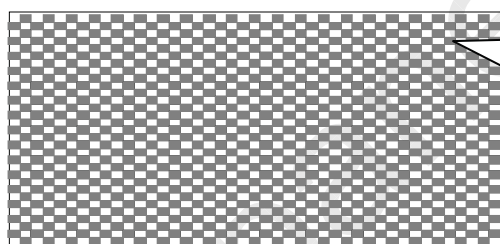
[Note 2] Typical current situation: 1024 gray-bar patterns. ($V_{cc} = +12.0V$)

The explanation of RGB gray scale is seen in section 8.

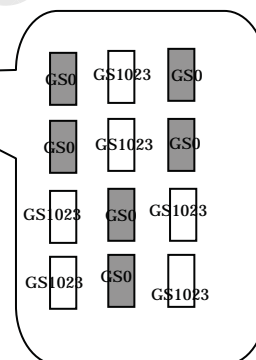


$V_{cc} = +12.0V$
 $CK = 74.25MHz$
 $Th = 14.1\mu s$

Max.current situation: 2H hatching pattern. ($V_{cc} = +12.0V$)



Zoom



Magnify

$V_{cc} = +12.0V$
 $CK = 74.25MHz$
 $Th = 14.8\mu s$

Fig.5 Typical/Worst Display pattern

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[Note 3]

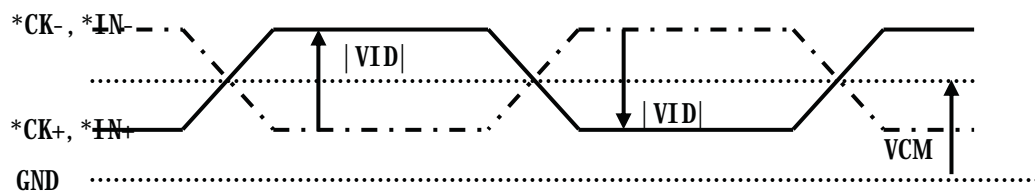


Fig.6 mini-LVDS Amplitude voltage

[Note 4]

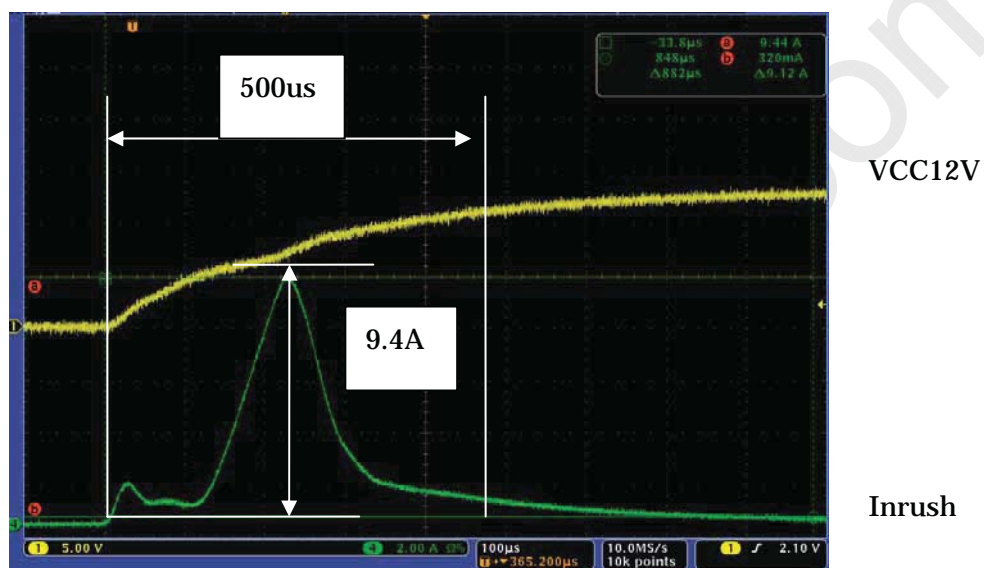


Fig.7 Inrush Current

[Note 5] I2C_SCL,I2C_SDA,B_INT,PANEL_SEL,FRC_PWR_CTRL
SA_MODE,PANEL_ON,FRC_RST,TCON_RDY



6.2. LED driving for back light

The back light system is edge light type with LEDs .

| Parameter | Symbol | Min. | Typ. | Max. | Unit | Remark |
|-------------------|-----------------|------|------|------|------|-----------------------|
| Operating Voltage | V _{op} | ±216 | ±230 | ±242 | V | @240mA/module |
| Operating Current | I _{op} | - | 120 | - | mA | 1 pair Current |
| | | - | 240 | - | mA | Total Current(2 pair) |

7. Timing characteristics of input signals

7.1. Timing characteristics

Timing diagrams of input signal are shown in Fig.3.

FRC Input Timing

| | Symbol | 60Hz | | | 50Hz | | | 24×2 | | |
|----------|--------|-------|--------|-------|-------|--------|-------|-------|--------|-------|
| | | min. | typ. | max. | min. | typ. | max. | min. | typ. | max. |
| H_Total | dot | 2184 | 2184 | 2184 | 2184 | 2184 | 2184 | 2184 | 2184 | 2184 |
| H_Active | dot | 1920 | 1920 | 1920 | 1920 | 1920 | 1920 | 1920 | 1920 | 1920 |
| H_FP① | dot | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| H_FP② | dot | 136 | 136 | 136 | 136 | 136 | 136 | 136 | 136 | 136 |
| HS_Width | dot | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 | 32 |
| H_BP① | dot | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 | 200 |
| H_BP② | dot | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| H_freq | kHz | | 67.995 | | | 67.995 | | | 67.995 | |
| V_Total | line | 1124 | 1134 | 1144 | 1347 | 1360 | 1374 | 1402 | 1416 | 1430 |
| V_Active | line | 1080 | 1080 | 1080 | 1080 | 1080 | 1080 | 1080 | 1080 | 1080 |
| V_FP | line | 24 | 34 | 44 | 247 | 260 | 274 | 302 | 316 | 330 |
| VS_Width | line | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| V_BP | line | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 | 16 |
| V_freq | Hz | 59.46 | 59.96 | 60.46 | 49.50 | 49.97 | 50.50 | 47.52 | 48.02 | 48.52 |
| PanelCLK | MHz | 73.51 | 74.25 | 74.99 | 73.51 | 74.25 | 74.99 | 73.51 | 74.25 | 74.99 |

[Note]-When vertical period is very long, flicker and etc. may occur.

- Please turn off the module after it shows the black screen.
- Please make sure that length of vertical period should become of an integral multiple of horizontal length of period. Otherwise, the screen may not display properly.
- As for your final setting of driving timing, we will conduct operation check test at our side, please inform your final setting.
- It is defined under the input signal condition with SS (60 kHz/±2%).

Htotal ; 2184±1 lines

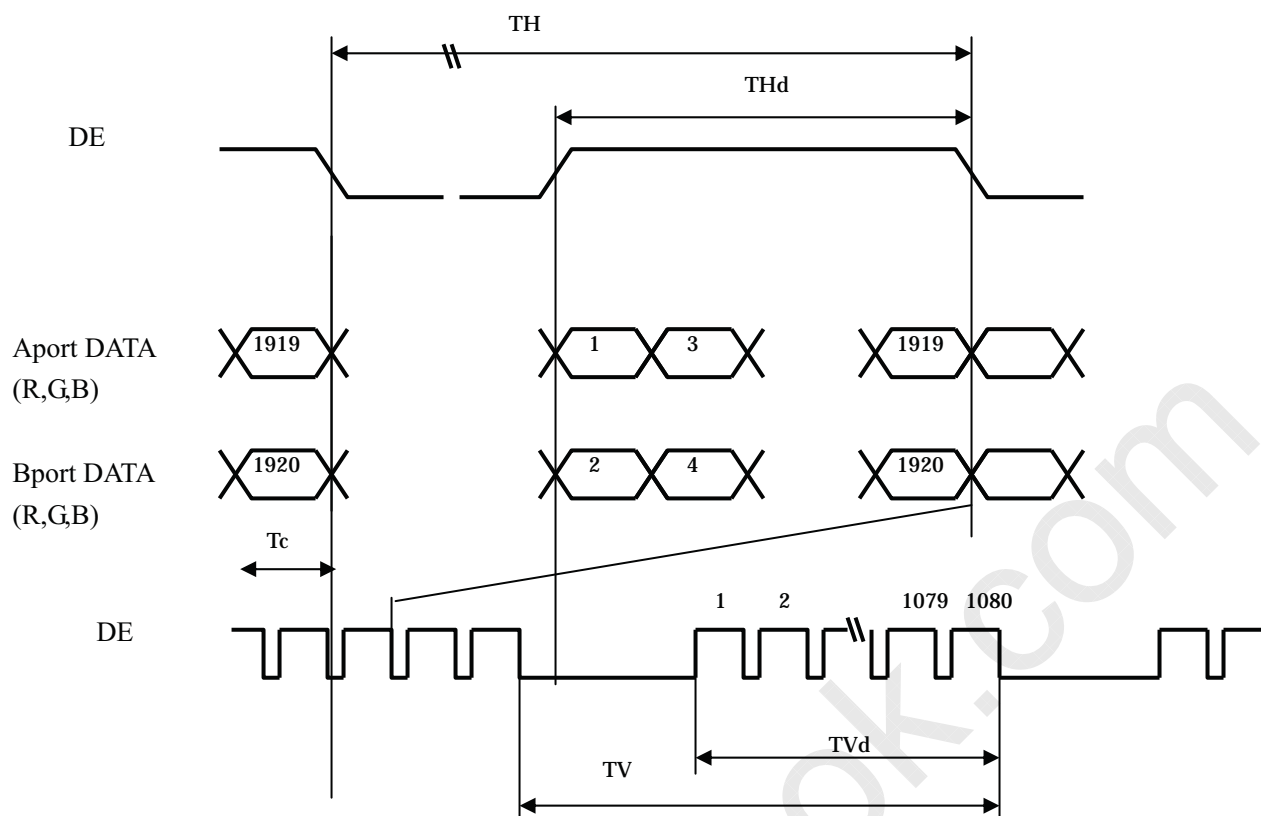


Fig.8 LVDS input timing chart

7.2. Input data signal and display position on the screen

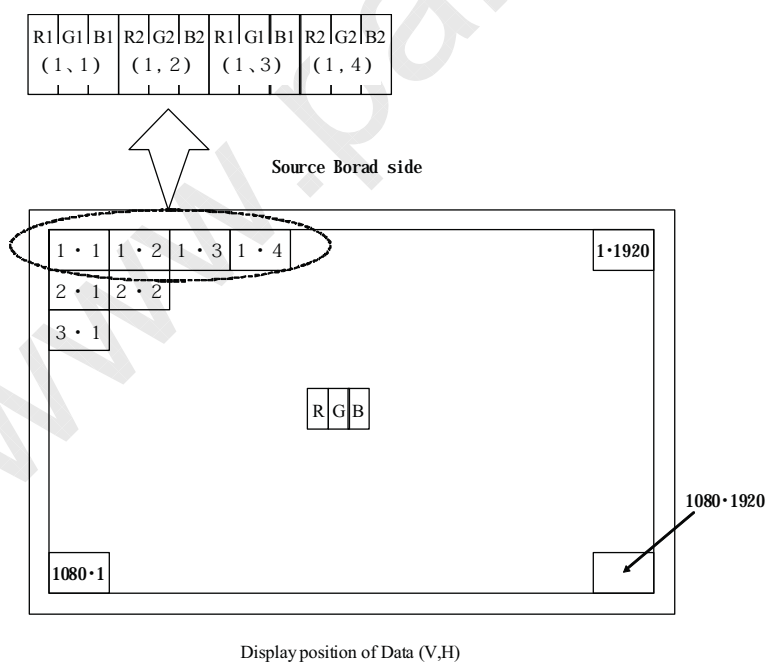


Fig.9 Input data signal and display position on the screen



8. Input Signal, Basic Display Colors and Gray Scale of Each Color

| | Colors & Gray scale | Data signal | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---------------------|---------------------|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|---|--|--|--|--|
| | | Gray Scale | R0 | R1 | R2 | R3 | R4 | R5 | R6 | R7 | R8 | R9 | G0 | G1 | G2 | G3 | G4 | G5 | G6 | G7 | G8 | G9 | B0 | B1 | B2 | B3 | B4 | B5 | B6 | B7 | B8 | B9 | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Basic Color | Black | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Blue | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | Green | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Cyan | — | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | Red | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Magenta | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | Yellow | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | White | — | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| Gray Scale of Red | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↑ | GS1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Darker | GS2 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↑ | ↓ | ↓ | | | | | | | | | ↓ | | | | | | | | | ↓ | | | | | | | | | | | | | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | | ↓ | | | | | | | | | ↓ | | | | | | | | | | | | | | | | |
| | Brighter | GS1021 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↓ | GS1022 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Red | GS1023 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| Gray Scale of Green | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↑ | ↓ | ↓ | | | | | | | | | ↓ | | | | | | | | | ↓ | | | | | | | | | | | | | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | | ↓ | | | | | | | | | ↓ | | | | | | | | | | | | | | | | |
| | Brighter | GS1021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↓ | GS1022 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Green | GS1023 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| Gray Scale of Blue | Black | GS0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↑ | GS1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | Darker | GS2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | | ↓ | | | | | | | | | ↓ | | | | | | | | | | | | | | | | |
| | ↓ | ↓ | ↓ | | | | | | | | | ↓ | | | | | | | | | ↓ | | | | | | | | | | | | | | | | |
| | Brighter | GS1021 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | ↓ | GS1022 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |
| | Blue | GS1023 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | | | |

0: Low level voltage, 1: High level voltage.

Each basic color can be displayed in 1021 gray scales from 10 bits data signals. According to the combination of total 30 bits data signals, one billion-color display can be achieved on the screen.

9. Optical characteristics

$T_a=25^{\circ}\text{C}$, $V_{cc}=12.0\text{V}$, LED current= $\pm 120\text{mA}$ and PWM=100%, Timing: 240Hz(typ. value)

| Parameter | | Symbol | Condition | Min. | Typ. | Max. | Unit | Remark |
|----------------------|------------|--------------------------------|---------------------------|-------|-------|-------|-----------------|-------------|
| Viewing angle range | Horizontal | θ_{21} θ_{22} | $CR \geq 10$ | 70 | 88 | - | Deg. | [Note1,4] |
| | Vertical | θ_{11} θ_{12} | | 70 | 88 | - | Deg. | |
| Contrast ratio | | CRn | $\theta = 0 \text{ deg.}$ | - | 5000 | - | - | [Note2,4] |
| Response time | | τ_{DRV} | | - | 4 | 8 | msec | [Note3,4,5] |
| Chromaticity | White | x | | 0.250 | 0.280 | 0.310 | - | [Note4] |
| | | y | | 0.255 | 0.285 | 0.315 | - | |
| | Red | x | | 0.642 | 0.647 | 0.652 | - | |
| | | y | | 0.339 | 0.344 | 0.349 | - | |
| | Green | x | | 0.298 | 0.303 | 0.308 | - | |
| | | y | | 0.647 | 0.652 | 0.657 | - | |
| | Blue | x | | 0.151 | 0.156 | 0.161 | - | |
| | | y | | 0.046 | 0.051 | 0.056 | - | |
| Luminance | White | Y_L | | 370 | 460 | - | cd/m^2 | |
| Luminance uniformity | White | δ_w | | - | - | 0.25 | - | [Note 6] |

Measurement condition: Set the value of LED current= $\pm 120\text{mA}$ and PWM=100% luminance of white.

*The measurement shall be executed 60 minutes after lighting at rating.

[Note] The optical characteristics are measured using the following equipment.

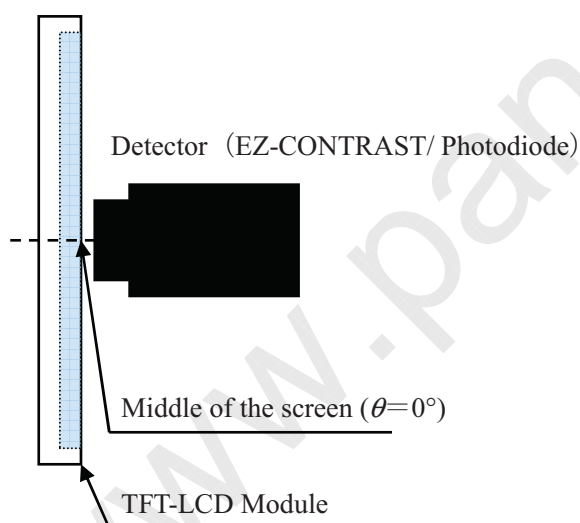


Fig.10-1 Measurement of Viewing angle range and Response time.

Viewing angle range: EZ-CONTRAST

Response time: Photodiode

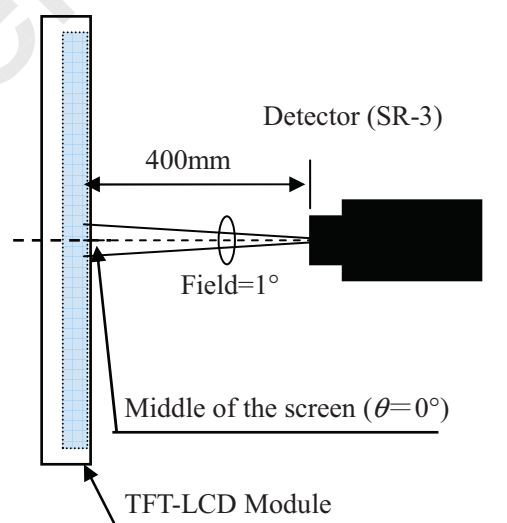


Fig.10-2 Measurement of Contrast, Luminance, and Chromaticity.

Fig.10 Optical measuring equipment

[Note 1] Definitions of viewing angle range :

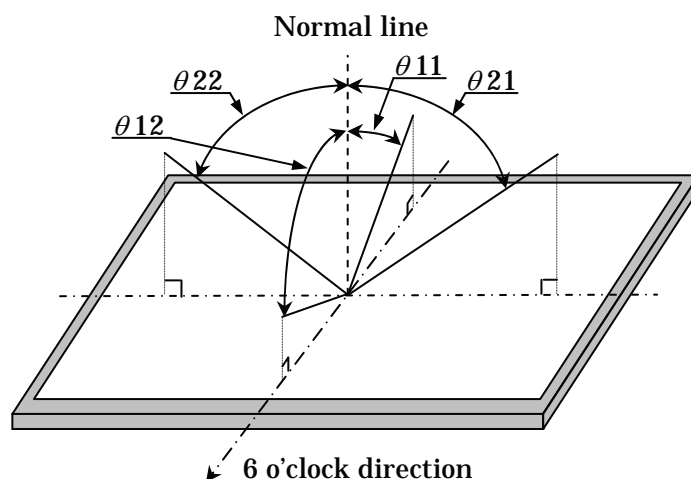


Fig.11 Optical measurement condition

[Note 2] Definition of contrast ratio :

The contrast ratio is defined as the following.

$$\text{Contrast Ratio} = \frac{\text{Luminance (brightness) with all pixels white}}{\text{Luminance (brightness) with all pixels black}}$$

[Note 3] Definition of response time

The response time (T_{DRV}) is defined as the following figure and shall be measured by switching the input signal for “any level of gray (0%, 25%, 50%, 75% and 100%)” and “any level of gray (0%, 25%, 50%, 75% and 100%)”.

| | 0% | 25% | 50% | 75% | 100% |
|------|-------------|--------------|--------------|-------------|--------------|
| 0% | | tr:0%-25% | tr:0%-50% | tr:0%-75% | tr:0%-100% |
| 25% | td: 25%-0% | | tr: 25%-50% | tr:25%-75% | tr: 25%-100% |
| 50% | td: 50%-0% | td: 50%-25% | | tr: 50%-75% | tr: 50%-100% |
| 75% | td: 75%-0% | td: 75%-25% | td: 75%-50% | | tr: 75%-100% |
| 100% | td: 100%-0% | td: 100%-25% | td: 100%-50% | td:100%-75% | |

$t^*:x-y$...response time from level of gray(x) to level of gray(y)

$$\tau_{DRV} = \Sigma(t^*:x-y)/20$$

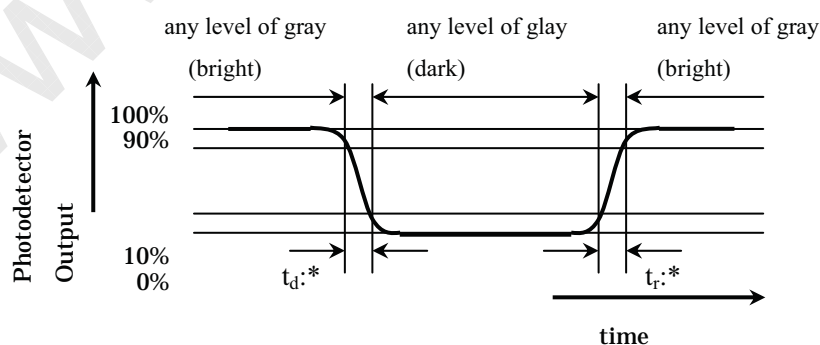


Fig.12 Definition of response time

[Note 4] This shall be measured at center of the screen.

[Note 5] This value is valid when O/S driving is used at typical input time value.

[Note 6] Definition of white uniformity ;

White uniformity is defined as the following with nine measurements. (A~I)

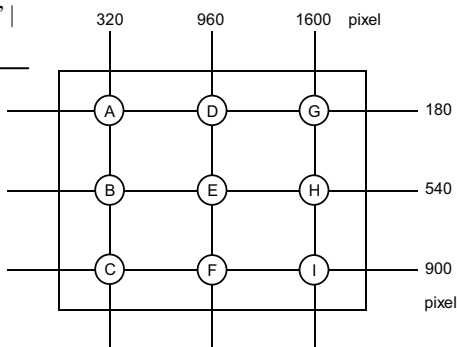
$$\delta_w = \frac{| \text{Maximum or Minimum luminance of nine points} - \text{Luminance of center point "E"} |}{\text{Luminance of center point "E"}}$$


Fig.13 Definition of white uniformity

10. Handling Precautions of the module

- a) Be sure to turn off the power supply when inserting or disconnecting the cable.
- b) Voltage difference generated by this switching, ΔV_{LED} , may affect a sound output, etc. when the power supply is shared between the LED driver and its surrounding circuit. So, separate the power supply of the LED driver circuit with the one of its surrounding circuit.
*Since LED driver board's GND is not connected to the frame of the LCD module, please connect it with the Customer's GND of LED driver power supply.
- c) Be sure to design the cabinet so that the module can be installed without any extra stress such as warp or twist.
- d) Since the front polarizer is easily damaged, pay attention not to scratch it.
- e) Since long contact with water may cause discoloration or spots, wipe off water drop immediately.
- f) When the panel surface is soiled, wipe it with absorbent cotton or other soft cloth.
- g) Since the panel is made of glass, it may break or crack if dropped or bumped on hard surface. Handle with care.
- h) Since CMOS LSI is used in this module, take care of static electricity and take the human earth into consideration when handling.
- i) The module has some printed circuit boards (PCBs) on the back side, take care to keep them from any stress or pressure when handling or installing the module; otherwise some of electronic parts on the PCBs may be damaged.
- j) Observe all other precautionary requirements in handling components.
- k) When some pressure is added onto the module from rear side constantly, it causes display non-uniformity issue, functional defect, etc. So, please avoid such design.
- l) When giving a touch to the panel at power on supply, it may cause some kinds of degradation. In that case, once turn off the power supply, and turn on after several seconds again, and that is disappear.
- m) When handling LCD modules and assembling them into cabinets, please be noted that long-term storage in the environment of oxidization or deoxidization gas and the use of such materials as reagent, solvent, adhesive, resin, etc. which generate these gasses, may cause corrosion and discoloration of the LCD modules.
- n) This LCD module is designed to prevent dust from entering into it. However, there would be a possibility to have a bad effect on display performance in case of having dust inside of LCD module. Therefore, please ensure to design your TV set to keep dust away around LCD module.



11. Packing form

- a) Piling number of cartons : 4 maximum
- b) Packing quantity in one carton : 12 pcs maximum
- c) Carton size : 1140 mm (W) × 1328(D) × 971(H)
- d) Total mass of one carton filled with full modules : 210kg maximum

[Note] Packing form are shown in Fig.18

12. Reliability test item

| No. | Test item | Condition |
|-----|---|--|
| 1 | High temperature storage test | Ta = 60°C 240h |
| 2 | Low temperature storage test | Ta = -25°C 240h |
| 3 | High temperature and high humidity operation test | Ta = 40°C ; 95%RH 240h (No condensation) |
| 4 | High temperature operation test | Ta = 50°C 240h |
| 5 | Low temperature operation test | Ta = 0°C 240h |
| 6 | Vibration test (non-operation) | Frequency: 10~57Hz/Vibration width (one side): 0.075mm : 57~500Hz/Acceleration: 9.8 m/s ² Sweep time: 11 minutes Test period: 3 hours (1h for each direction of X, Y, Z) |
| 7 | Shock test (non-operation) | Maximum acceleration: 294m/s ² Pulse width: 11ms, sinusoidal half wave Direction: +/-X, +/-Y, +/-Z, once for each direction. |
| 8 | ESD | * At the following conditions, it is a thing without incorrect operation and destruction. (1)Non-operation: Contact electric discharge ±10kV Non-contact electric discharge ±20kV (2)Operation Contact electric discharge ±8kV Non-contact electric discharge ±15kV Conditions: 150pF, 330ohm |

[Result evaluation criteria]

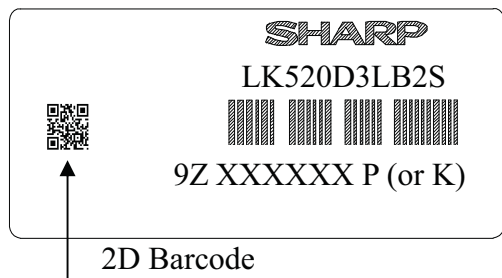
Under the display quality test condition with normal operation state, there shall be no change, which may affect practical display function.

13. Others

1) Lot No. Label ;

The label that displays SHARP, product model (LK520D3LB2S), a product number is stuck on the back of the module.

[LK520D3LB2SP, 2SK] NSEC PRODUCTION



Model No.

←

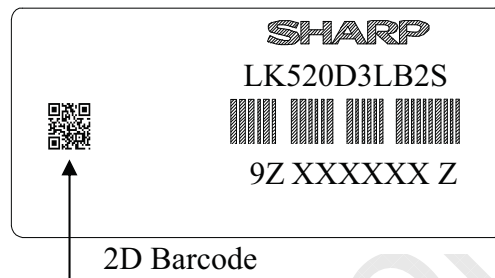
Barcode

←

Lot No.

←

[LK520D3LB2SZ] SEMEX PRODUCTION



Model No.

←

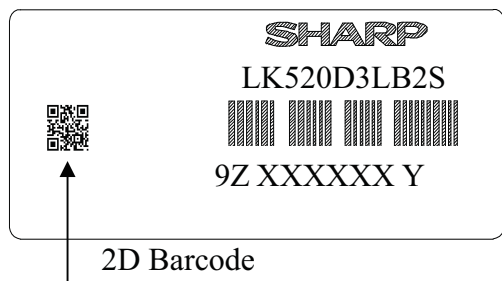
Barcode

←

Lot No.

←

[LK520D3LB2SY] SMPL PRODUCTION



Model No.

←

Barcode

←

Lot No.

←

How to express Lot No.

A production year(the last figures of the Christian Era)

A production month (1-9,X,Y,Z)

Serial No.

Management No.

Identification Code

K:Kameyama Plant.

L:Kameyama Tec. Kameyama Fab.

J:Kameyama Tec. Yaita Fab.

S:SHM

N:NSEC

P:SMPL

G:SMM

X:SEMEX

A or B:JABIL

Fig.14 Lot number label description specification

LD- K21Y20-20

2) Packing Label

[LK520D3LB2SP,2SK] NSEC PRODUCTION

社内品番 : (4 S) LK520D3LB3SP (K) (①)

Bar code

Lot NO. (1 T) 2 0 * . * . * . * * * * * (②)

Bar code

Quantity : (O) 12 p c s (③)

Bar code

ユーザ品番 1-811-095-11

Bar code

シャープ物流用ラベルです。

[LK520D3LB2SZ] SEMEX PRODUCTION

MODEL : (4 S) LK520D3LB3SZ (①)

Bar code

Lot NO. (1 T) 2 0 * . * . * . * * * * * (②)

Bar code

Quantity : (O) 12 p c s (③)

Bar code

ユーザ品番 1-811-095-31

Bar code

シャープ物流用ラベルです。

[LK520D3LB2SY] SMPL PRODUCTION

社内品番 : (4 S) LK520D3LB2SY (①)

Bar code

Lot NO. (1 T) 2 0 * . * . * . * * * * * (②)

Bar code

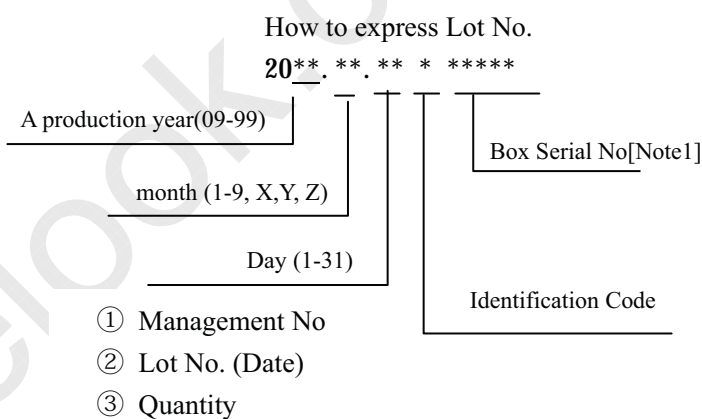
Quantity : (O) 12 p c s (③)

Bar code

ユーザ品番 1-811-095-21

Bar code

シャープ物流用ラベルです。



[Note 1] Box Serial Number is nine digits only the JABIL POLAND production, and besides, five digits.

Fig.15 Packing label description specification

3)Material Label

MATERIAL INFORMATION

Reflective Polarizer: >PC. PEST, AKUR-X, PC<

Lens Film: >PC<

Diffuser Sheet: >PET<

Light Guide: >PMMA<

Reflective Sheet: >PET<

Fig.16 Material label description specification

4) Adjusting volume has been set optimally before shipment, so do not change any adjusted value.

If adjusted value is changed, the specification may not be satisfied.

5) Disassembling the module can cause permanent damage and should be strictly avoided.

6) Please be careful since image retention may occur when a fixed pattern is displayed for a long time.

7) The chemical compound, which causes the destruction of ozone layer, is not being used.

8) When any question or issue occurs, it shall be solved by mutual discussion.

9) This module is corresponded to RoHS.

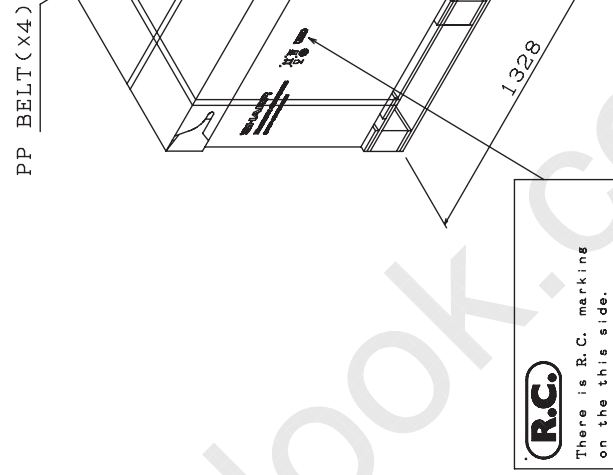
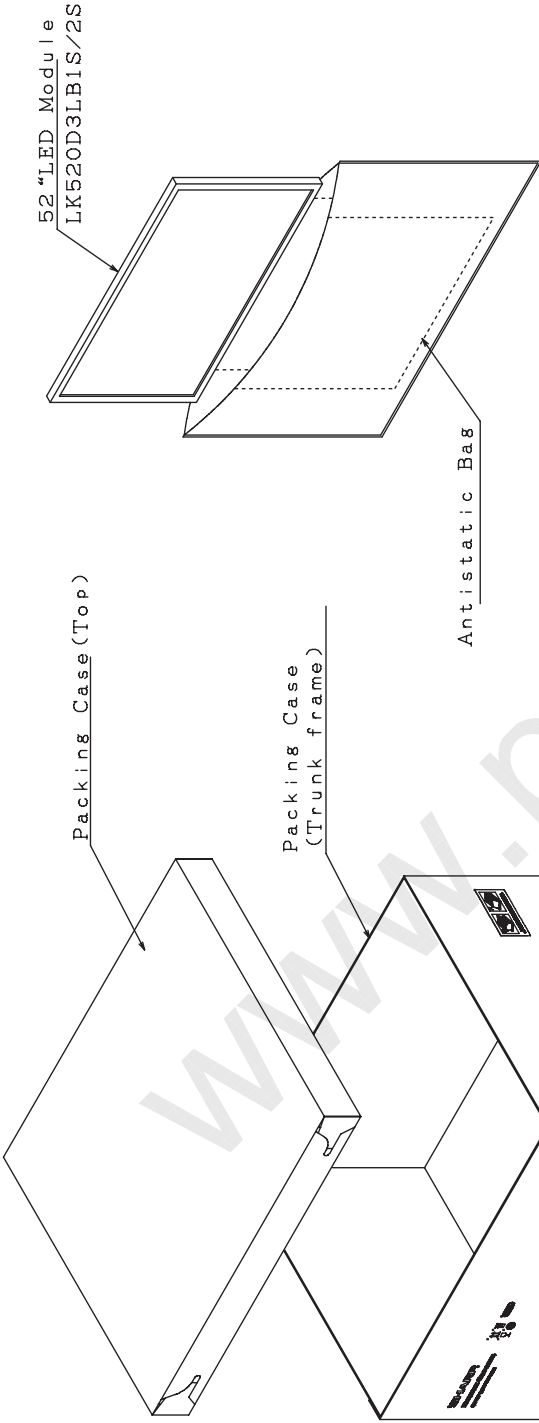


14. Carton storage condition

| | |
|---------------------|--|
| Temperature | 0°C to 40°C |
| Humidity | 95%RH or less |
| Reference condition | : 20°C to 35°C, 85%RH or less (summer) : 5°C to 15°C, 85%RH or less (winter) • the total storage time (40°C,95%RH) : 240H or less |
| Sunlight | Be sure to shelter a product from the direct sunlight. |
| Atmosphere | Harmful gas, such as acid and alkali which bites electronic components and/or wires must not be detected. |
| Notes | Be sure to put cartons on palette or base, don't put it on floor, and store them with removing from wall Please take care of ventilation in storehouse and around cartons, and control changing temperature is within limits of natural environment |
| Storage life | 1 year |



| Parts Name | Material |
|---------------------------|----------------------|
| Packing Case(Top) | Cardboard |
| Pack Ado(Bottom) | PS |
| Pack Ado(TopA) | PS |
| Pack Ado(TopB) | PS |
| Packing Case(Trunk frame) | Cardboard |
| Cardboard Prop | Cardboard |
| Plywood Palette | Heat treatment woods |
| Antistatic Bag | PE($t=20\mu$) |



《Architect's Conception》

Fig.18 LK520D3LB2S Packing Form

